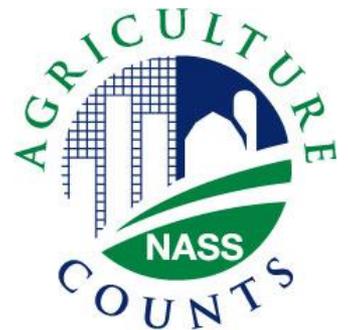


A Stochastic /Deterministic Hybrid Approach to Solving the Cell Suppression Problem in 3-Dimensional Tables with Multi-Level Row Hierarchical Structure .

Matt Fetter- USDA/NASS

January 2012 FCSM Conference, Washington, D.C.



RCLEX-D

- STOCHASTIC MODULE (JSM 2010 Proceedings)
- DETERMINISTIC MODULE
- SPLIT FLOW MODULE

Objective:

Minimize The Total Cell Value
Suppressed.

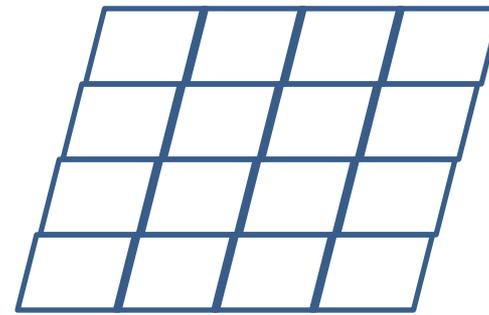
Subject to:

Path is "Closed"

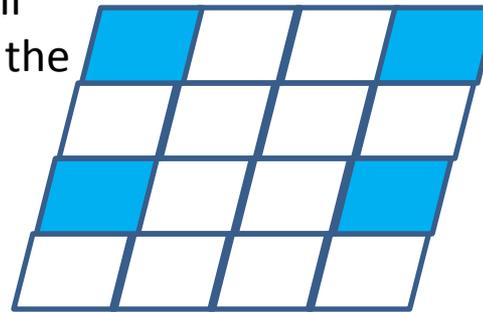
Sensitive Cells are Protected.

Definition- 3D Closed Path

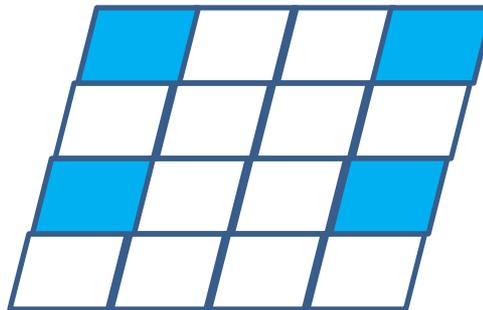
A set of cells in a 3D table that for every cell in the set, there is exactly one other cell in the set that is in the same column and level, exactly one other cell in the set that is in the same row and level, and exactly one other cell in the set that is in the same row and column.



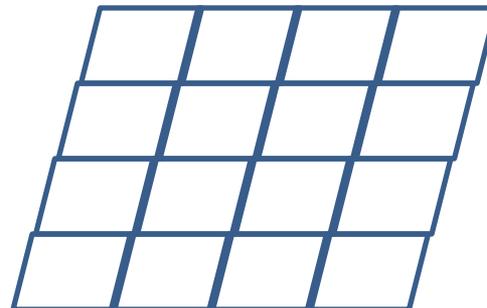
Level 1



Level 2



Level 3

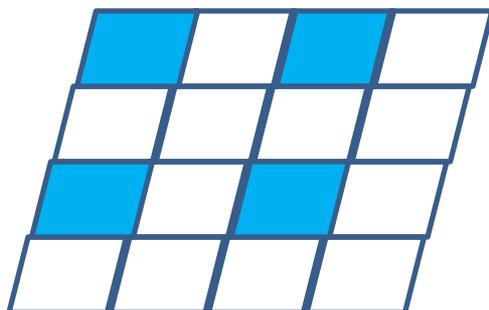
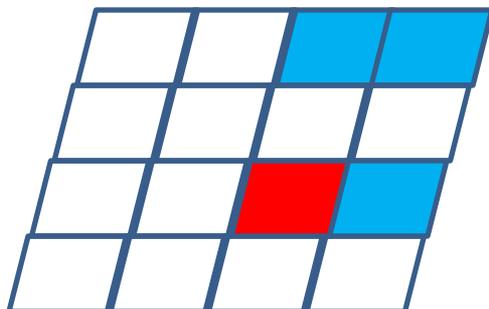
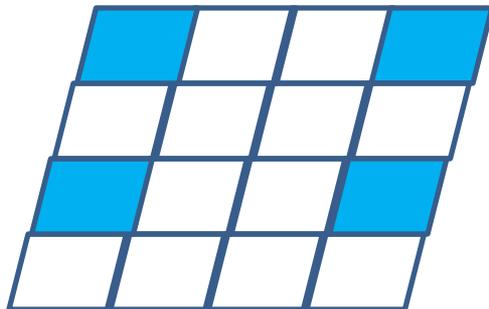
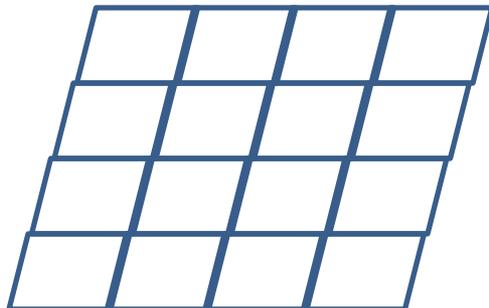


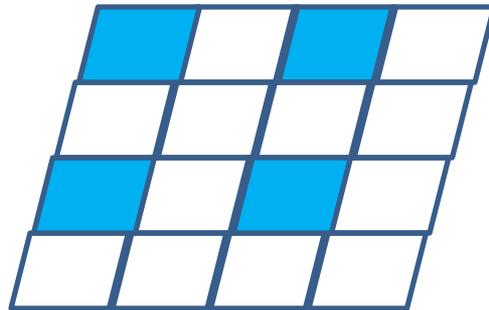
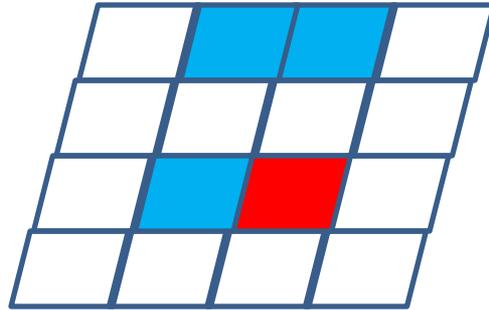
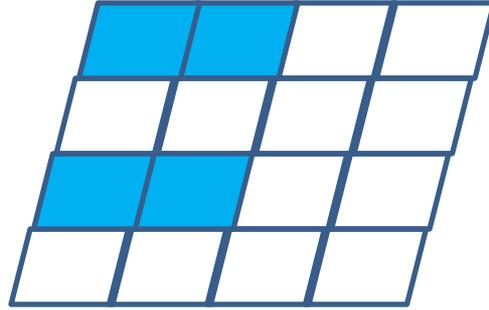
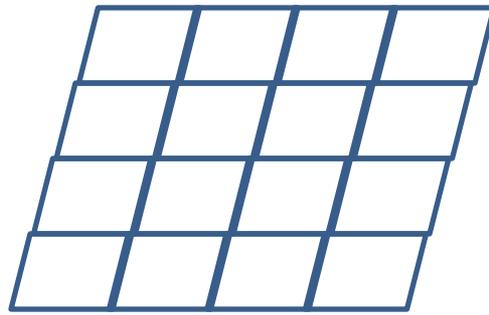
Level 4

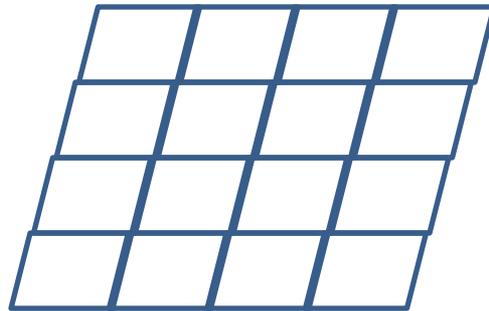
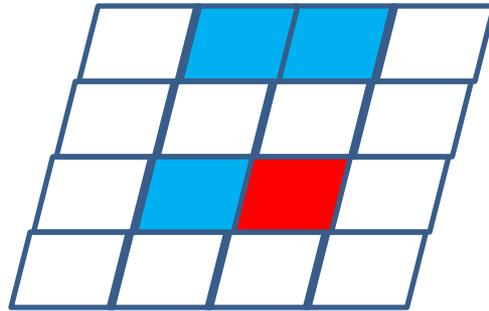
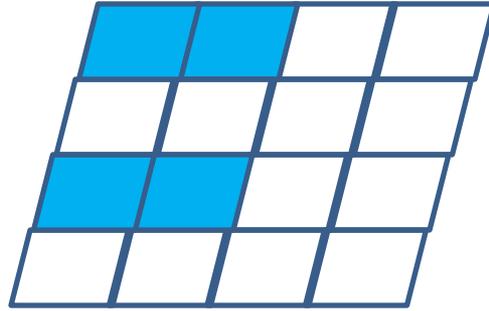
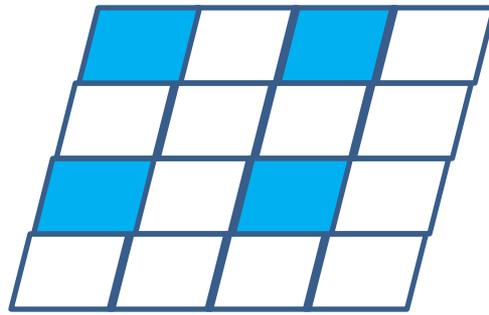
Each cell is identified by an ordered triple.

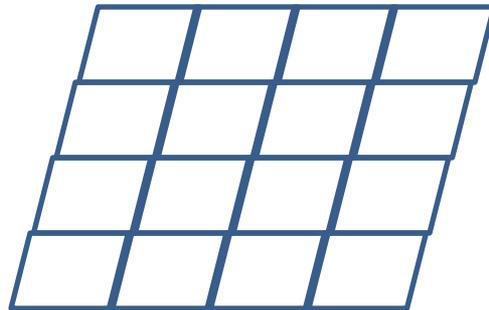
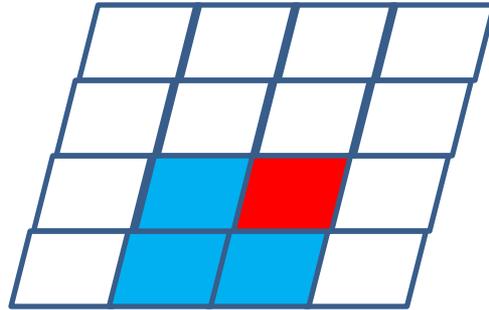
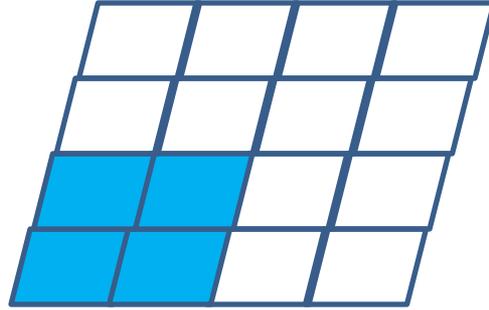
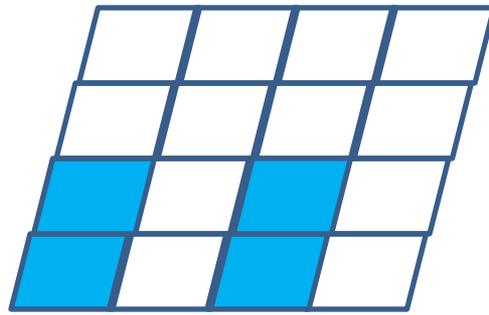
(column, row, level)

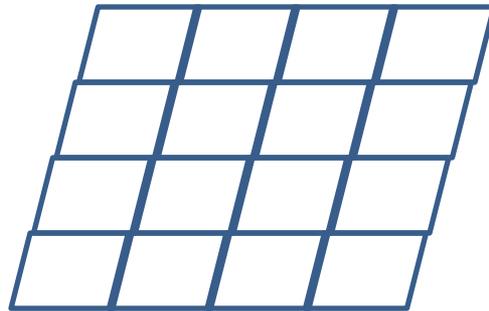
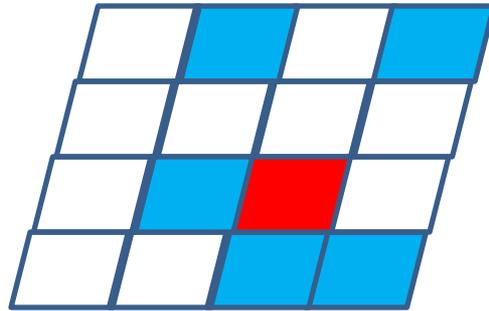
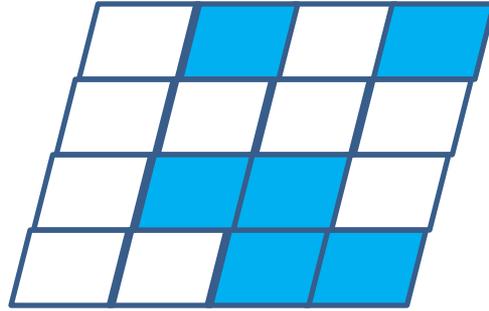
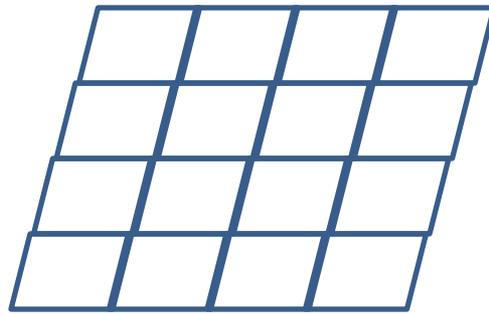
(X, Y, Z)

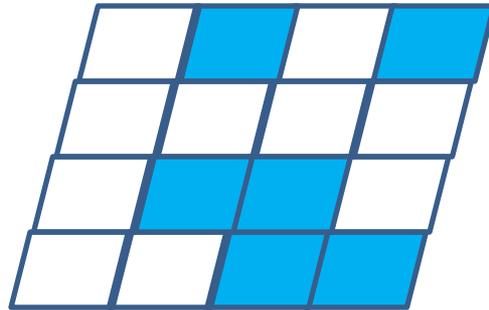
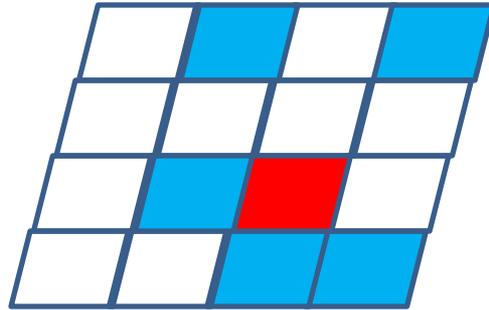
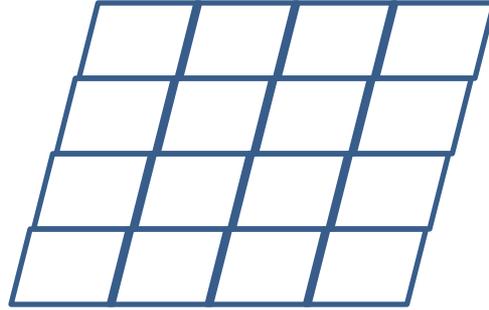
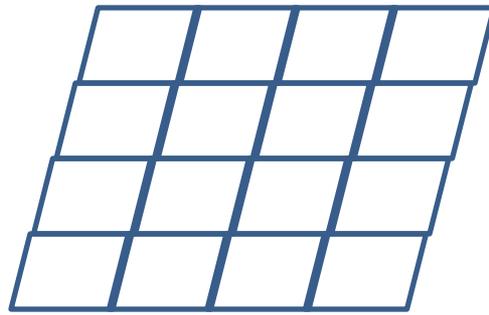


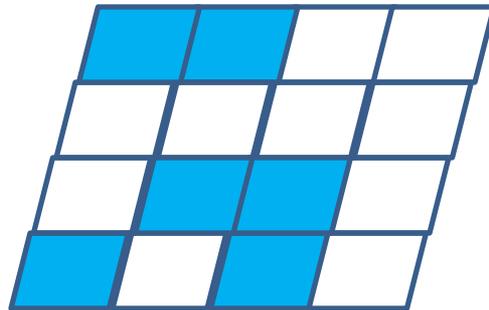
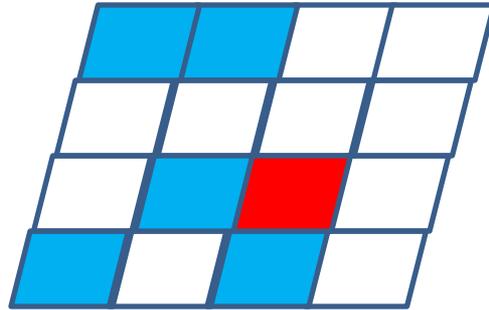
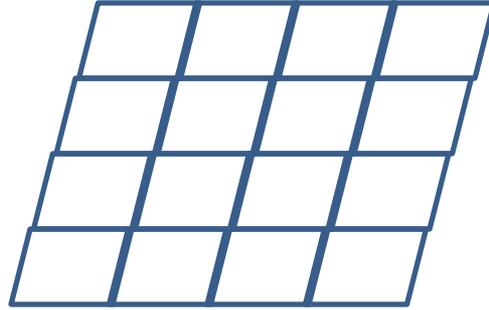
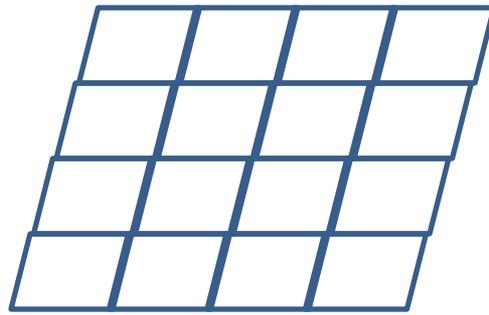


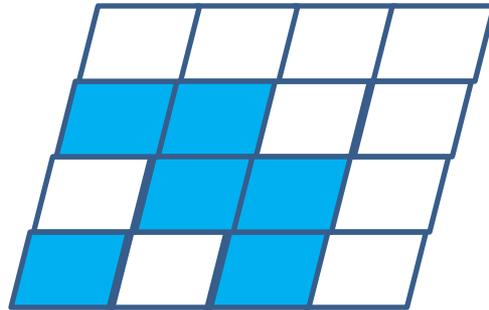
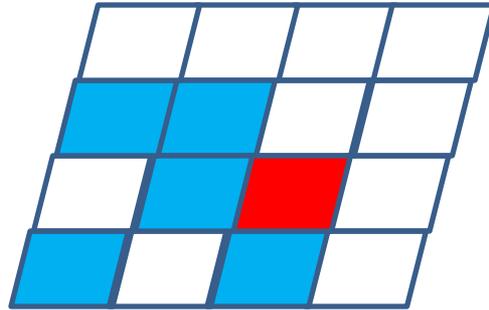
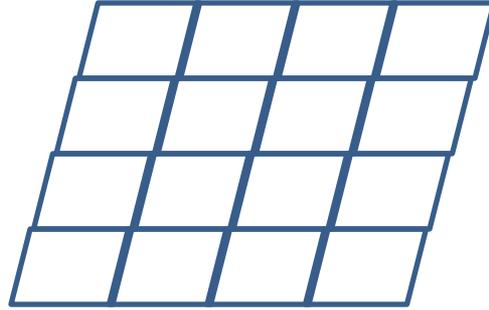
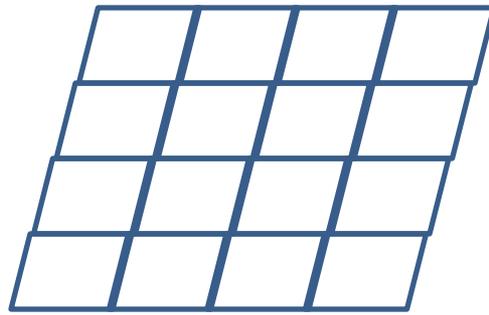


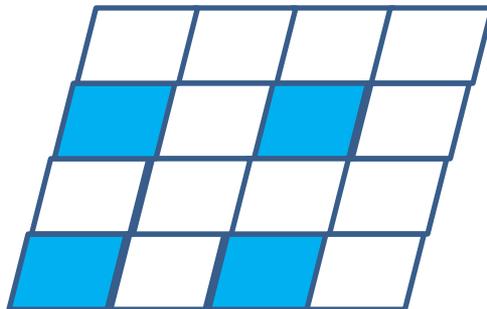
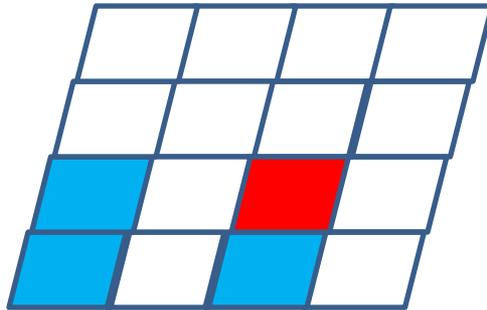
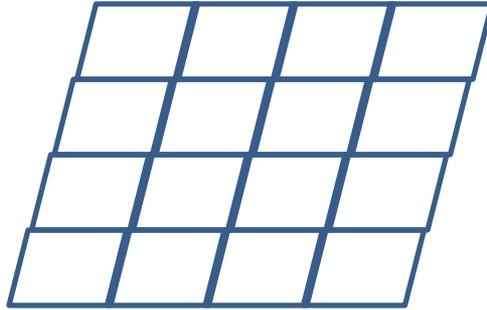
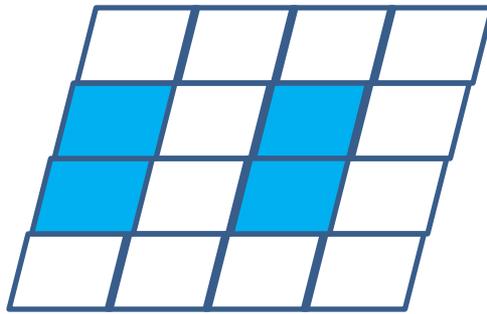


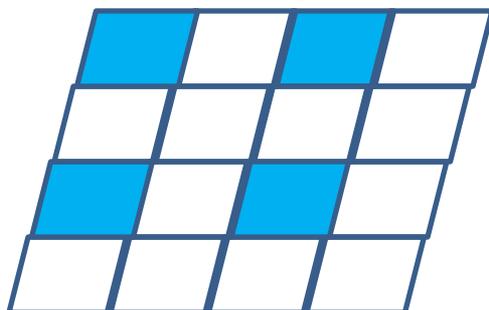
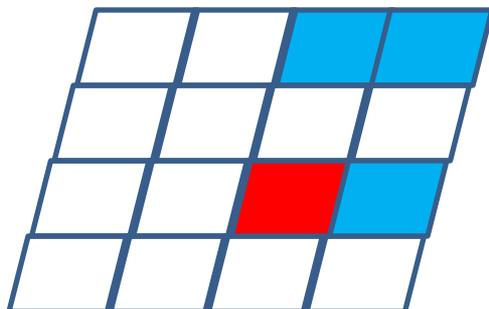
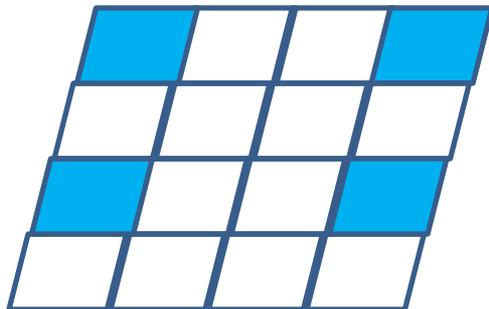
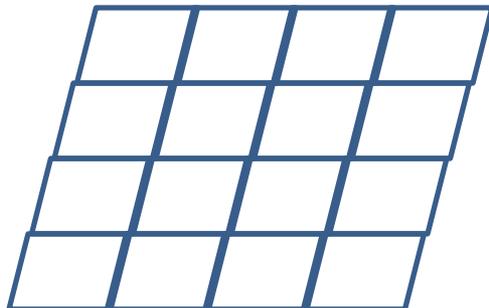






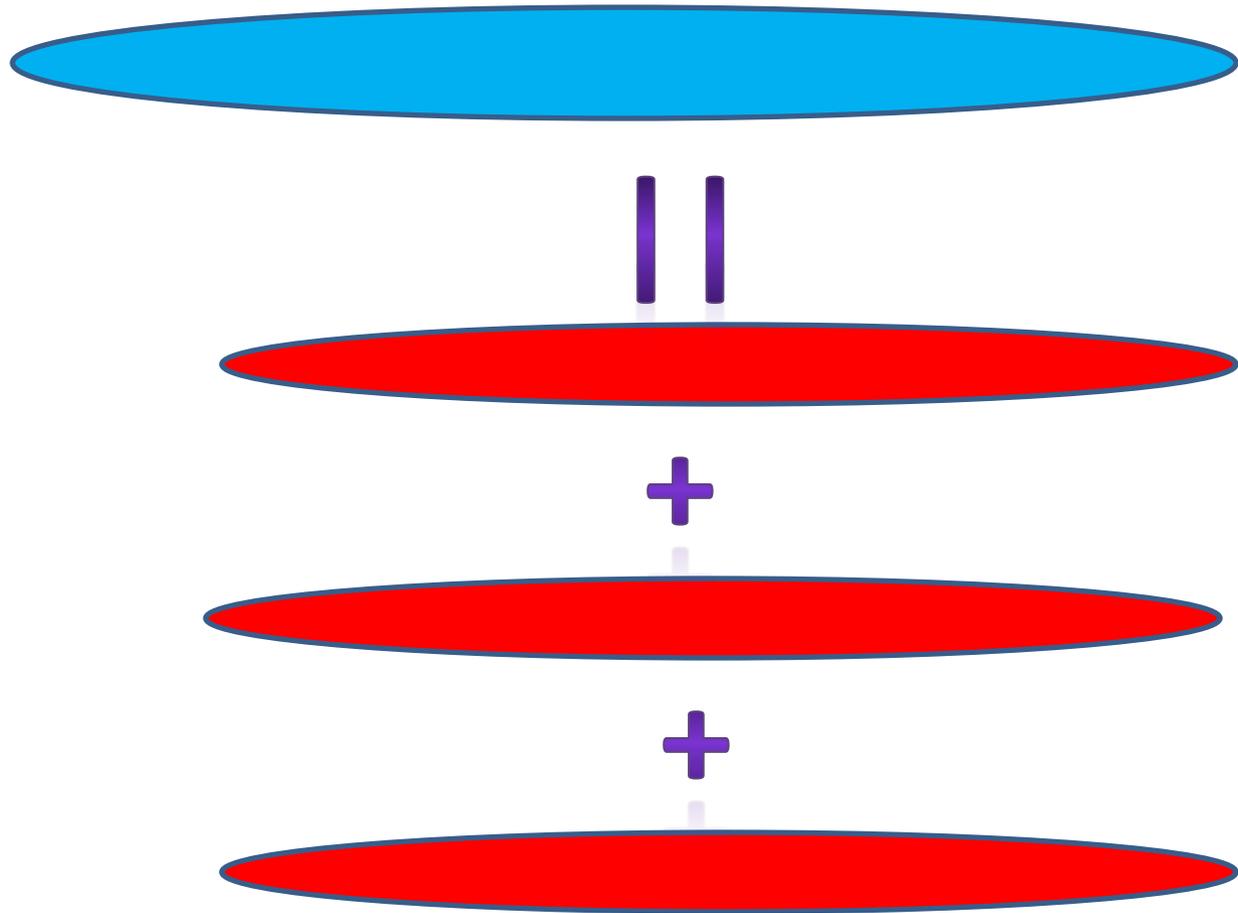




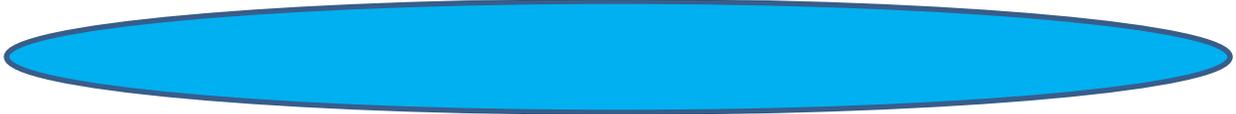


Problem:

**THE STOCHASTIC MODULE
ONLY WORKS
WITH SIMPLE TABLES**



Simple (2-Level Row Hierarchy)



Working with....



Hierarchical Row Structure



The Deterministic Module

Conditions on Current Stochastic Iteration Result

Fires after each iteration of the stochastic module whenever necessary.

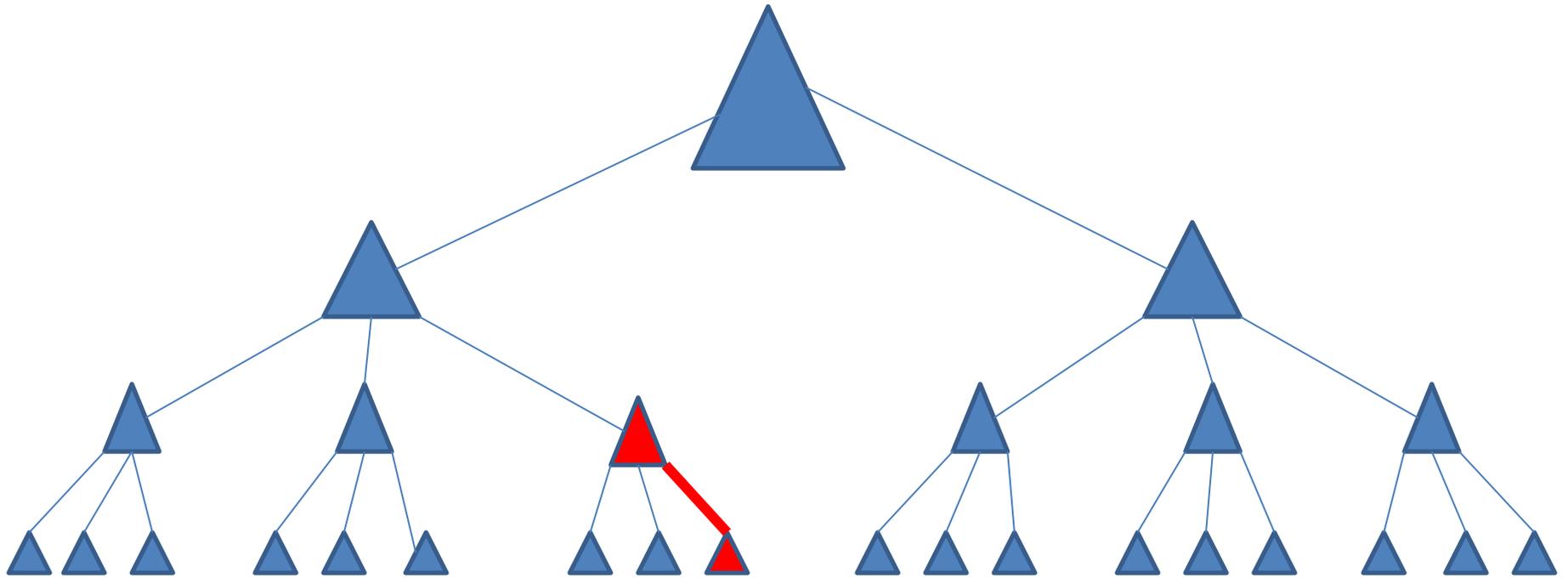
Deterministic Solution Analysis Constrained to:

**Columns and Table Levels
involved with the current
Stochastic Module
candidate solution.**

Keeps things manageable...

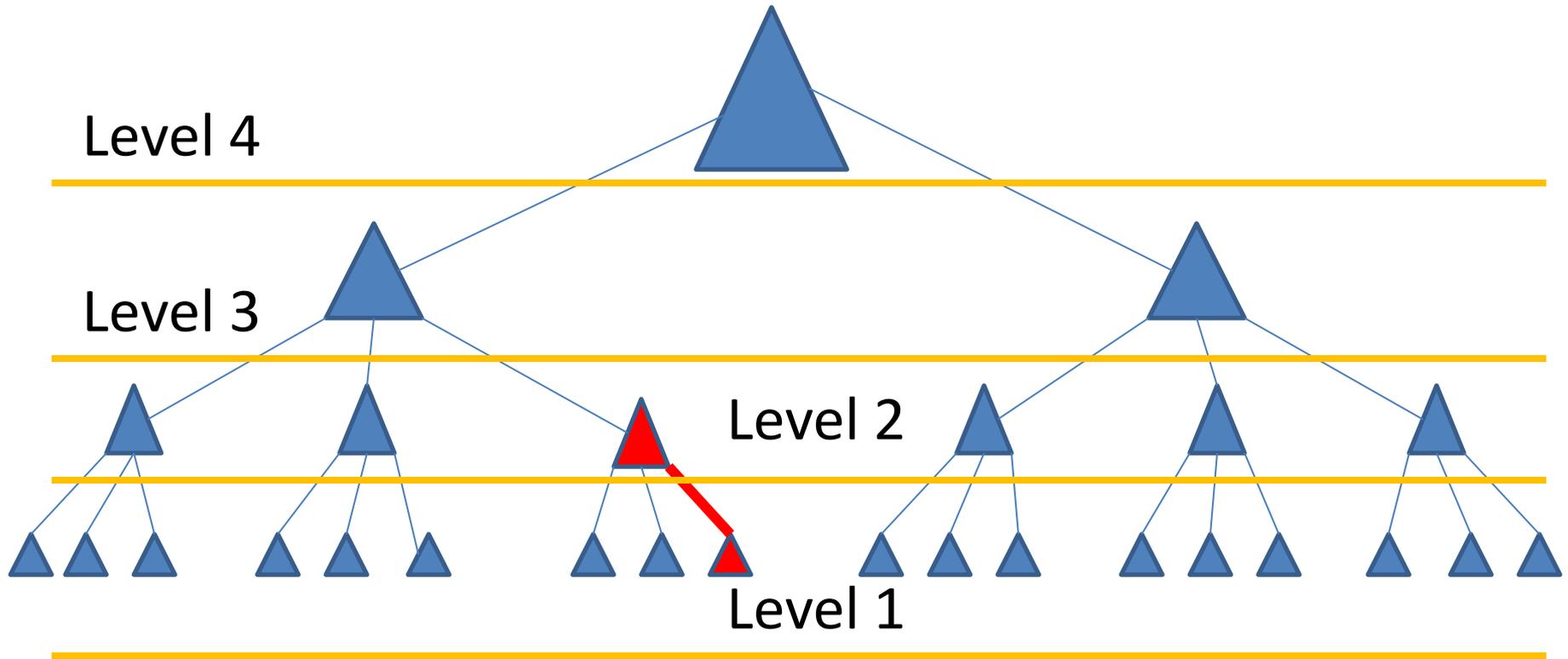
**...but misses some of the
solution space.**

Row Diagram- X,Z Fixed

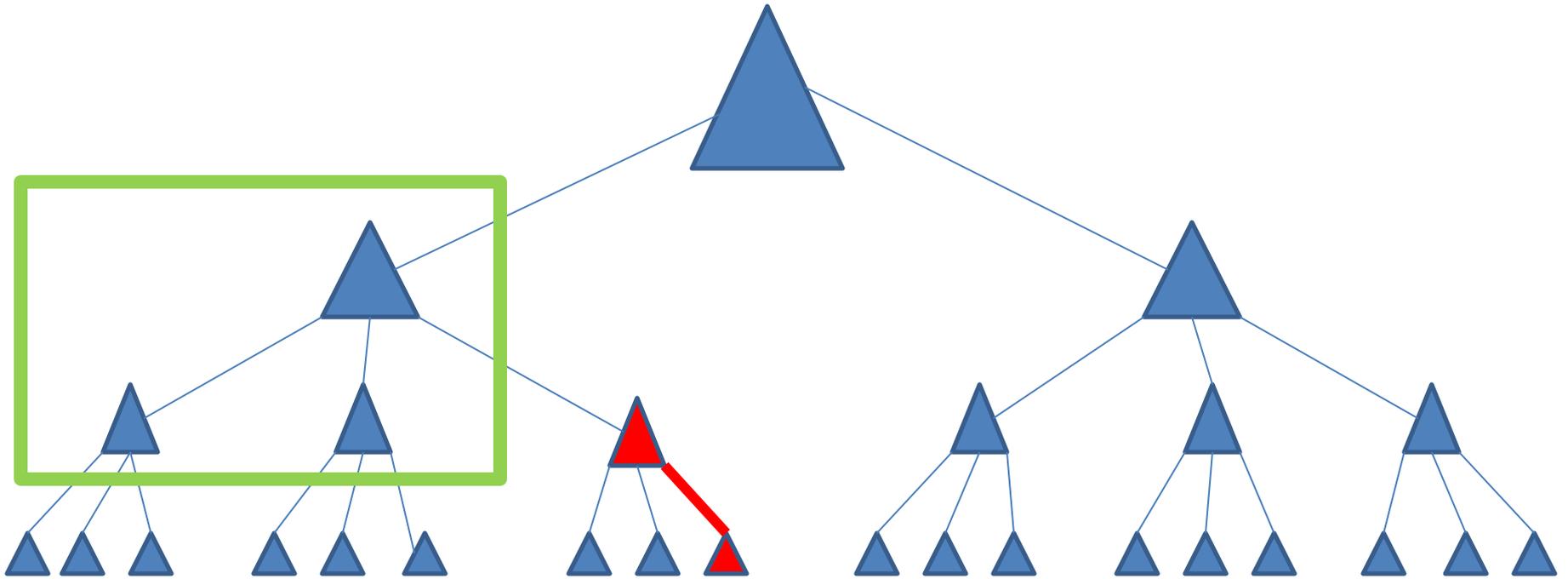


4-Level Row Hierarchy

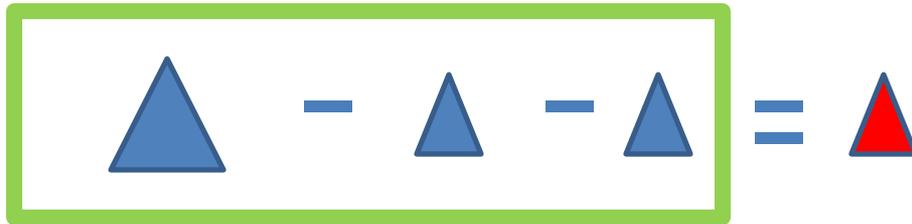
Row Diagram



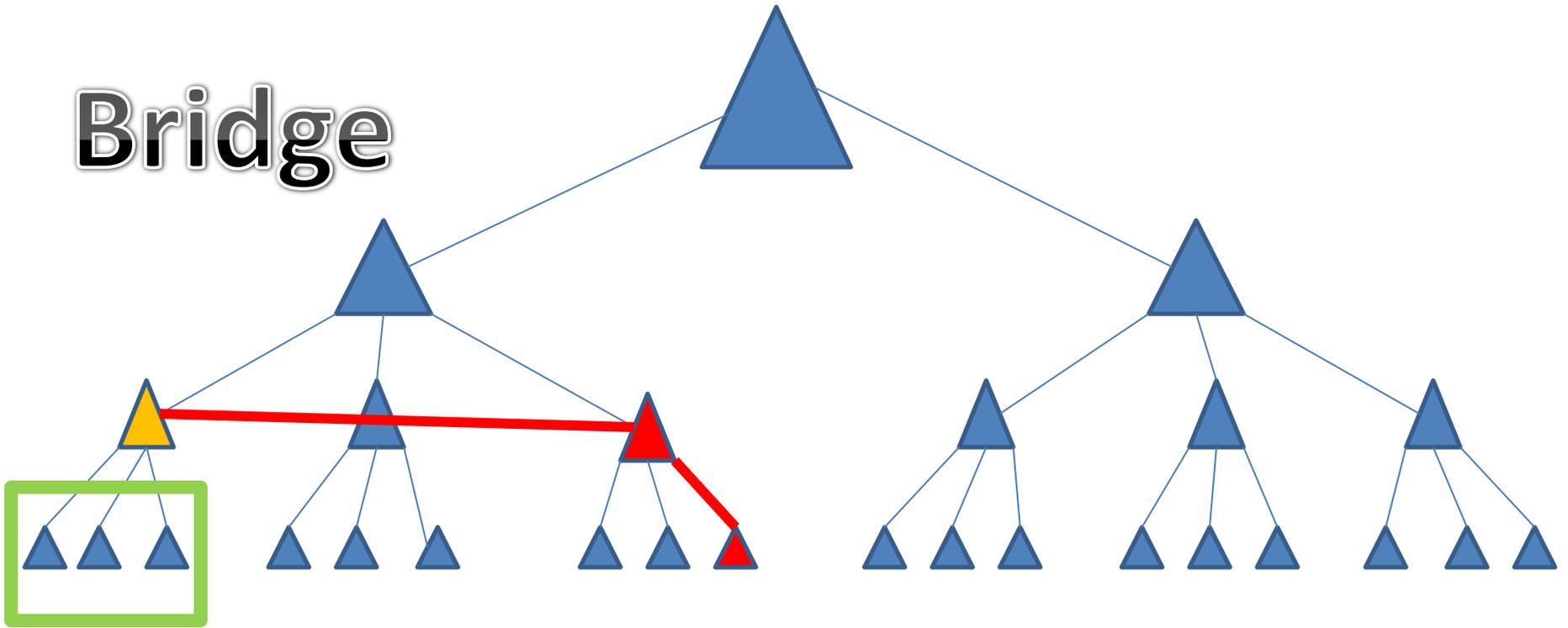
4-Level Row Hierarchy



Vulnerable from Top



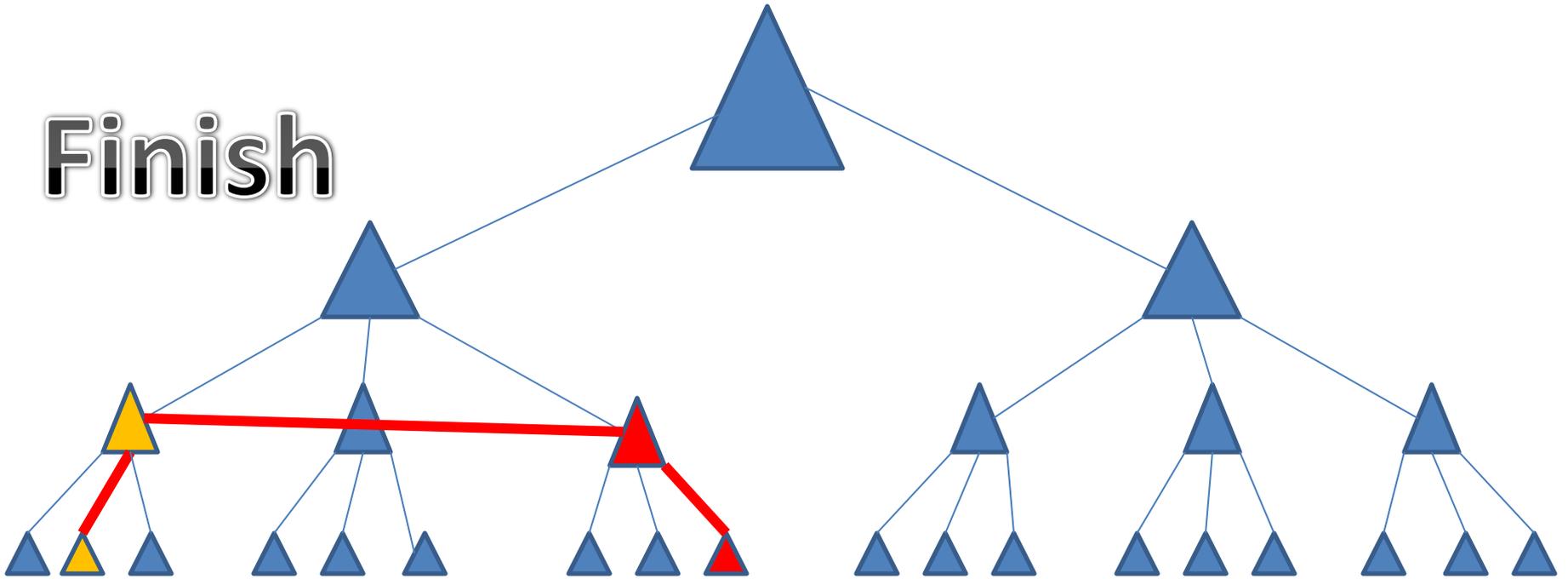
Bridge



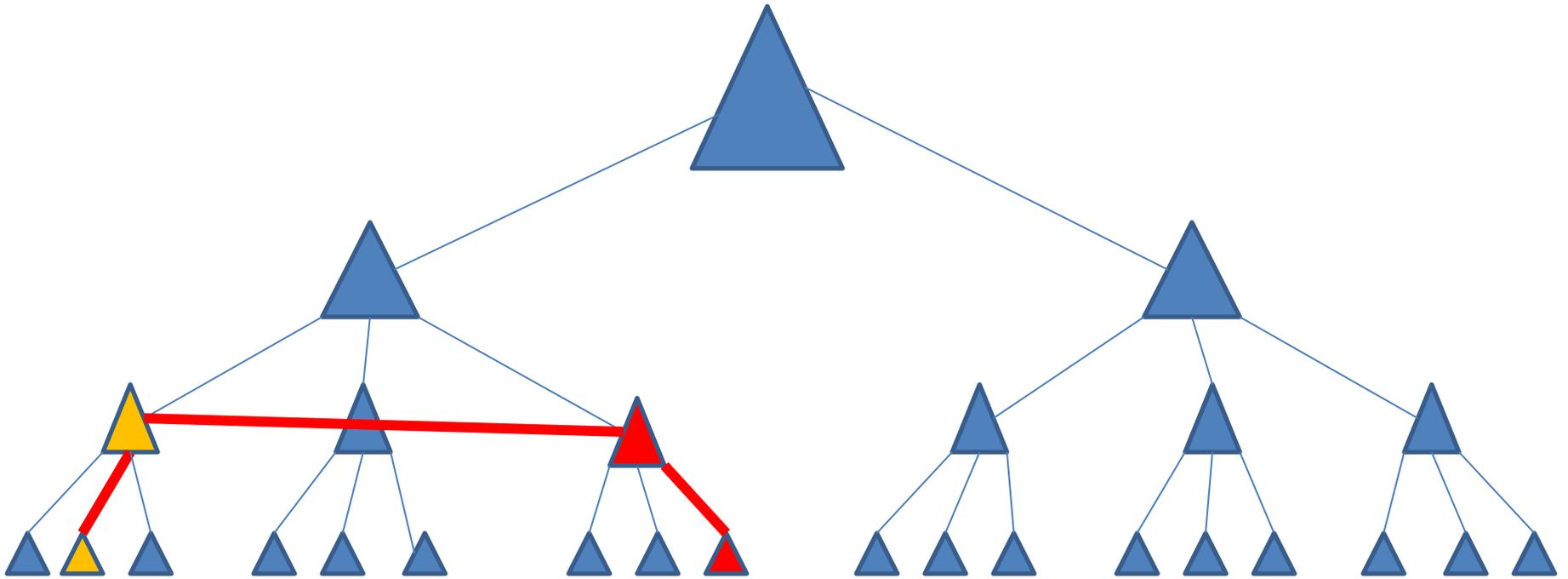
Vulnerable from Bottom



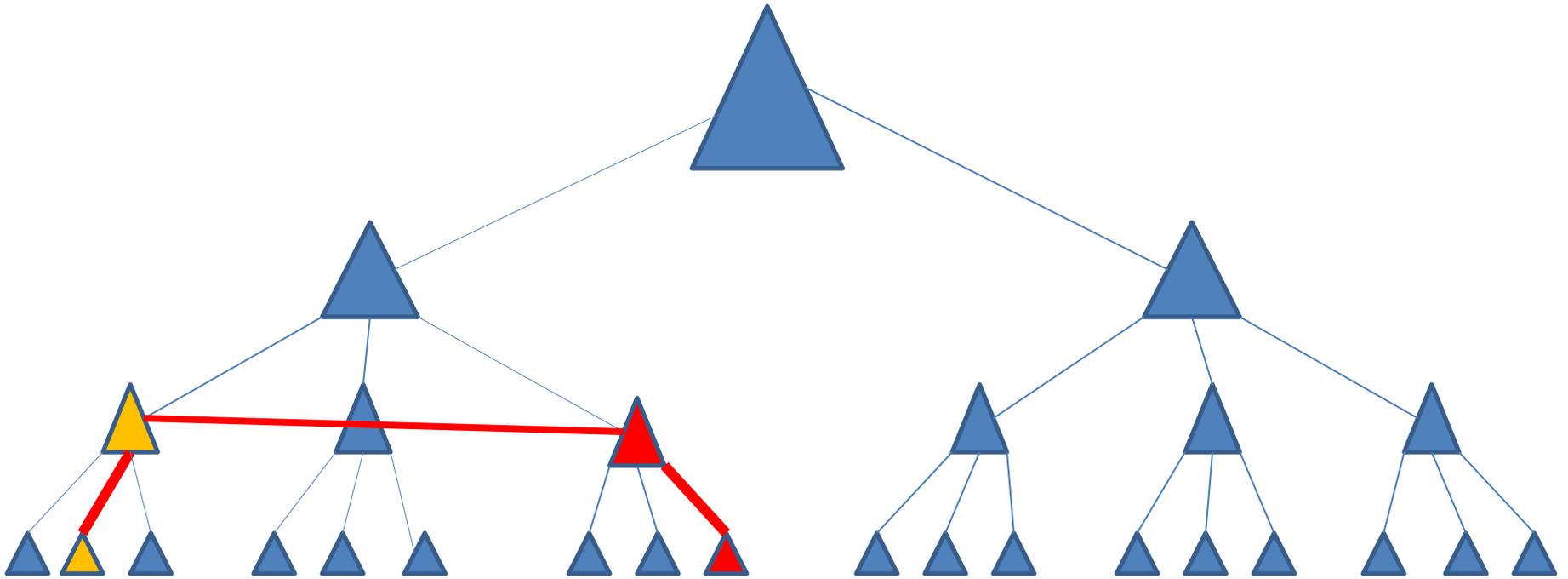
Finish



Protected Top & Bottom



Bridge and Finish



Cheapest Path is Chosen

Column (X)	Row (Y)	Level (Z)		Hierarchical Level	Level 3	Level 2			
2	5	3		1	1	1			
3	5	3		1	1	1			
2	3	3		2	1	1			
3	3	3		2	1	1			
2	5	1		1	1	1			
3	5	1		1	1	1			
2	3	1		2	1	1			
3	3	1		2	1	1			
2	11	1		2	1	3			
3	11	1		2	1	3			
2	14	1		1	1	3			
3	14	1		1	1	3			
2	11	3		2	1	3			
3	11	3		2	1	3			
2	14	3		1	1	3			
3	14	3		1	1	3			

4 Level Row Hierarchy

Bridge & Finish Example

In Summary:

RCLEX-D Consists of 3 Components.

A Stochastic Search Module-

Assures that the solution is closed wrt the “simple” table.

A Deterministic Module-

Assures that the solution is closed wrt the hierarchical row structure.

A Multi-Path Module-

Constrains the stochastic module solution to base rows
Whenever it's deemed efficient and possible. (Split flow.)